RAILWAY WEATHER SIGNALS.

Professor P. H. Mell, jr., director of the "Alabama Weather Service," in his report for June, states:

The verification of prediction for the whole state was 98 per cent. for temperature and 97 per cent. for weather.

The following roads comprise this system: Western, of Alabama; Atlanta and West Point, of Georgia; South and North; Montgomery and Mobile; Mobile and Girard; Georgia Pacific; East Tennessee, Virginia and Georgia; Northeastern, of Georgia.

ATMOSPHERIC ELECTRICITY.

AURORAS.

Auroral displays were observed during June, as follows:

1st.—Marquette, Michigan: an aurora was observed from 11 to 11.20 p. m.

1st.—Escanaba, Michigan: faint aurora from 10.42 to 11.28 p. m.

1st.—Mountainville, New York.

1st.—Yutan, Nebraska.

2d.—Mountainville, New York.

3d.—Cambridge, Massachusetts: aurora suspected.

3d.—Mount Washington, New Hampshire: at 11 p. m. an auroral light, with occasional streamers, extended over 80° of horizon, and to an altitude of 15°; the display ended during the early morning of the 4th.

3d.—Eastport, Maine: a very faint auroral arch of 10° altitude was observed from 7.30 to 10 p. m.

4th.—Blackwell, North Carolina: "auroral light flashing up in the northwest at 8.10 p. m." A similar display was also observed on the 8th.

4th.—Ithaca, New York: a faint auroral arch was visible at 10 p. m.

5th.—Sussex, Wisconsin.

7th.—Yutan, Nebraska.

8th.—Eastport, Maine: a faint auroral light, of pale straw color, was observed from 9 p. m. until 1 a. m. of the 9th.

8th.—Readville, Massachusetts (Blue Hill observatory): aurora at 11.15 p. m.

8th and 11th.—Yutan, Nebraska.

13th.—Webster, Dakota.

13th.—Yutan, Nebraska.

15th.—Wellsborough, Pennsylvania.

16th.—Yutan, Nebraska.

18th.—Tiffin, Ohio.

19th.—Bangor, Maine.

22d.—Fort Bennett, Dakota: an aurora was observed from 10.25 to 10.55 p. m., consisting of columns of light; cloudiness partially obscured the display.

22d.—Westerville, Ohio.

23d.—Mountainville, New York.

23d.—Syracuse, New York.

24th.—Hudson, Michigan.

24th.—Manhattan, Kansas: quite a marked auroral display was observed at 9.20 p. m.; notwithstanding the moonlight, streamers, extending nearly to the North star, were visible.

24th.—Fort Bennett, Dakota: an aurora was visible from 10.58 to 11.20 p. m., consisting of an arch which spanned 45° of the horizon and extended to an altitude of 20°; from the arch several columns of pale light extended upward 45°.

24th.—Huron, Dakota: auroral beams were observed at intervals during the evening; a similar display was also observed during the evening of the 25th.

24th.—Fort Totten, Dakota: an auroral display was visible from 10 p. m. until daylight of the 25th; shooting beams of greenish color, with a motion from west to east, extended to the zenith from all parts of the northern sky; the display was most brilliant at 11.55 p. m.

24th.—Marquette, Michigan: an aurora was observed from 11 to 11.40 p. m.; streamers extended beyond the zenith. The display resembled that observed here on May 27th.

24th.—Alpena, Michigan: an aurora appeared at 8.50 p. m., consisting of a diffuse light on the northern horizon; at 10 p. m. beams, having an apparent motion from east to west, shot towards the zenith; at 11.50 p. m. the beams faded away and the display disappeared at 12.40 a. m. on the 25th.

24th.—Escanaba, Michigan: a bright aurora appeared at 9.43 p. m.; the light rested upon a dark segment which extended to an altitude of 20°; beams rose to within 15° of the zenith, and occasional flashes of light, resembling lightning, were observed.

24th.—Oswego, New York: an auroral display, partly obscured by cloudiness, was observed from 10.30 p. m. until the early morning of the 25th.

24th.—Erie, Pennsylvania: an aurora was visible from 10.40 to 11.20 p. m., extending from northeast to northwest; streamers rose to an altitude of 45°.

24th.—Portland, Maine: a faint auroral display was observed from 10.30 p. m. until after midnight.

24th.—Mount Washington, New Hampshire: an aurora appeared at 9.22 p. m.; the display consisted of irregular streamers, of varying brilliancy, extending to the zenith.

24th.—Rochester, New York: a faint aurora was observed at 10.25 p. m., extending from northeast to northwest and to an altitude of 25°; the display consisted of a pale, yellow light; no streamers were visible.

24th.—Westerville, Ohio.

25th.—Gardiner, Maine: bright auroral beams were observed at 11.30 p. m., although the moon shone brightly at that hour.

25th.—Cambridge, Massachusetts: aurora suspected.

25th.—Westerville, Ohio.

25th.—Bismarck, Dakota: a faint aurora was observed at 1.15 a. m., covering 90° of the horizon and extending to an altitude of 45°

25th.—Fort Totten, Dakota: auroral light in the north at 11.55 p. m., with bright, shooting beams of yellow and green colors. At 1.20 a. m. on the 26th the display was still visible.

26th.—Fort Totten, Dakota: aurora from 10 p. m. until 1 a. m. of the 27th.

30th.—Westerville, Ohio.

THUNDER-STORMS.

Thunder-storms occurred in the various districts as follows:

New England.—1st, 4th, 5th, 7th, 8th, 9th, 14th, 16th, 17th, 22d, 23d, 24th, 26th to 30th.

Middle Atlantic states.—2d, 4th, 5th, 7th, 8th, 11th, 14th to 17th, 21st, 22d, 25th to 28th.

South Atlantic states.—3d, 5th, 7th to 13th, 15th to 30th.

Florida peninsula.—4th to 18th, 20th, 21st, 23d to 27th, 29th, 30th.

East Gulf states.—8th, 10th to 14th, 16th to 20th, 22d to 26th, 29th.

West Gulf states.—7th to 30th.

Rio Grande valley.—14th, 24th, 25th, 28th, 30th.

Tennessee.—3d to 16th, 20th, 21st, 22d, 25th, 26th, 27th, 29th.

Ohio valley.—2d to 8th, 11th to 16th, 19th, 20th 21st, 26th, 27th, 28th.

Lower lake region.—3d to 8th, 12th to 16th, 20th to 23d, 26th, 27th, 28th.

Upper lake region.—1st to 4th, 6th, 7th, 11th to 15th, 18th to 21st, 26th, 27th, 28th.

Extreme northwest.—1st to 6th, 9th to 14th, 16th, 18th, 19th, 20th, 25th, 26th, 27th, 29th.

Upper Mississippi valley.—1st to 16th, 18th to 22d, 25th, 26th, 27th.

Missouri valley.—1st to 30th.

Northern slope.—1st to 5th, 8th, 10th to 14th, 17th to 20th, 22d to 30th.

Middle slope.—1st, 2d, 4th, 5th, 8th, 9th, 10th, 15th to 30th.

Southern slope.—3d, 4th, 7th to 11th, 13th to 18th, 22d, 23d, 24th, 26th to 30th.

Southern plateau.—2d to 5th, 14th, 17th, 18th, 21st to 24th, 26th to 30th.

Middle plateau.—4th, 5th, 9th, 13th, 14th, 19th to 23d, 25th, 29th, 30th.

Northern plateau.—1st, 3d, 5th, 9th to 17th, 19 to 25th, 28th, 29th, 30th.

North Pacific coast region.—5th, 9th, 11th, 14th to 17th, 24th, 25th.

Middle Pacific coast region.—Red Bluff, 15th; Oroville, 23d, 30th; College City, 8th, 17th, 22d, 23d, 29th.

The following notes upon the thunder-storms of the month have been prepared by Junior Professor H. A. Hazen:

The collection of data, relating to thunder-storms, upon special cards, has been continued the present year. A large number of the observers of last year continue their records. It is desired that all who take an interest in this matter may aid in this work. Instructions and postage free cards will be sent any one sending his address to the Chief Signal Officer. During June nearly 3,000 distinct records have been received. The days having the largest number of storms were the 7th, 14th, 15th, 20th, 21st, and 27th. Nearly all these storms occurred to the southeast and east of quite marked barometric depressions. A special investigation of storms, at stations about four miles apart in Ohio, has been begun. The storms of the 14th, 100; of the 15th, 200; of the 20th, 225, and of the 21st, 280, have been carefully plotted upon maps, and have shown very interesting results. On the 15th destructive storms are reported from three places in Shelby county, between 13.30h. and 14h. The most extensive series of storms on this date, however, are in a belt about thirty miles wide, running across the state from west to east, with its centre in latitude 39° 30′. High winds and damaging storms are reported from twenty-one places. These began at 13.30h. in the west and ended at 18.30h. in the east. The mean velocity across the state was over forty miles per hour, while the storm-centre had a velocity less than thirty miles. The mean distance from the centre of the depression was five hundred and fifty miles in a sse. direction. These twenty-one storms were surrounded by thunder-storms of less severity and, in many instances, at the boundary of electric action, there were gentle rains without thunder.

On the 21st storms were much more general over the whole state. A group of destructive storms are found in the northeast of the state occurring between 17h. and 20h. Nearly in the centre of this were the tornadoes at Ravenna and Marlborough. As on the 15th, these storms were surrounded by those of much less intensity. The mean velocity of the barometric depression was twenty-six miles, and of the thunder-storm movement thirty-five miles. The following are given as a few of the characteristics of electric storms, as determined by the studies thus far:

1st. A barometric depression is almost an invariable accompaniment. If storms occur without such depression, they are light, and more or less sporadic.

2d. A temperature much above the normal precedes general electric action; this high temperature extends over the whole region, nearly to the low centre, or at least to where rain is falling, in which case the precipitation has a tendency to diminish the heat.

3d. The wind over this region, just before the action sets in, is from the s. or sw., and light, following the law of the gentle gradient to the north.

4th. The storms, with few exceptions, move from the sw. to the ne.

5th. They are almost invariably immediately preceded by a high wind, blowing directly from the centre of most intense action. If the wind takes any other direction, it is from a point slightly to the right of the centre of action, never to the left, *i. e.*, in a direction with the hands of a clock about the centre of action.

6th. This electric action is general over the region to the se. of a low area, though there may be frequent gaps in this region. They seem like sudden outbursts of energy in the atmosphere, dependent indirectly in some unexplained manner upon the barometric depression, though having a velocity somewhat greater than it.

ELECTRICAL PHENOMENA.

Bismarck, Dakota: from 10 p. m. of the 26th until midnight the telegraph wires were so charged with atmospheric electricity that signals were transmitted without the aid of battery, between this place and Fort Yates, Dakota.

The observer on the summit of Pike's Peak reports the following: "during a thunder-storm, on the afternoon of the 28th, unusual electrical manifestations were observed. All pointed objects, even the tips of one's fingers and eyebrows, produced a buzzing noise, resembling the sound made by bees."

OPTICAL PHENOMENA.

SOLAR HALOS.

Solar halos were observed in the various states and territories as follows:

Arizona.—17th, 30th.
Arkansas.—3d, 8th, 10th, 14th, 15th, 19th, 20th, 22d, 26th.
California.—4th, 12th, 14th, 16th, 17th, 19th, 20th, 22d, 23d, 24th, 26th, 27th.
Connecticut.—12th, 20th, 25th.
Dakota.—1st, 5th, 18th, 19th, 20th.
District of Columbia.—1st, 10th.
Florida.—1st to 4th, 8th, 9th, 27th.
Georgia.—2d, 4th, 16th, 18th, 22d.
Illinois.—5th, 9th, 15th, 24th, 25th, 30th.
Indiana.—10th, 30th.
Iowa.—5th, 26th, 30th.
Kansas.—10th, 17th, 18th, 22d, 26th, 29th, 30th.
Maine.—3d, 6th.
Massachusetts.—3d, 21st, 25th, 26th.
Michigan.—4th, 7th, 11th, 24th.
Minnesota.—2d.
Missouri.—3d, 9th, 10th, 16th, 18th, 19th, 20th, 22d, 27th.
New Jersey.—10th, 21st.
New York.—3d, 10th, 11th, 14th, 20th.
North Carolina.—3d, 4th.
Ohio.—3d, 10th, 12th, 13th, 14th, 20th, 21st, 25th, 26th, 27th.
Oregon.—2d, 3d, 4th, 6th, 7th, 8th, 22d, 23d to 29th.
Pennsylvania.—3d, 19th, 25th, 27th.
South Carolina.—2d, 4th, 19th, 25th.
Tennessee.—12th, 15th, 21st, 23d.
Texas.—El Paso, 1st.
Virginia.—3d, 12th, 19th, 29th.
Washington Territory.—19th, 27th, 28th, 29th.
Wisconsin.—Beloit, 16th.
Wyoming.—8th, 9th, 13th, 15th.

LUNAR HALOS.

Lunar halos were observed in the various states and territories as follows:

Arizona.—16th, 20th, 21st, 24th, 26th.
Arkansas.—20th, 24th, 27th.
California.—16th to 19th, 22d.
Colorado.—23d.
Connecticut.—20th, 24th.
Dakota.—17th, 24th, 25th.
Florida.—17th, 18th, 23d, 26th, 27th, 29th.
Georgia.—2d, 4th, 5th, 23d to 27th.
Illinois.—18th, 20th, 21st, 22d, 24th, 25th, 26th.
Indiana.—2d, 16th, 18th, 19th, 21st, 23d to 26th.
Iowa.—24th, 25th, 26th.
Kansas.—15th to 18th, 20th, 23d to 28th, 30th.
Kentucky.—Frankfort, 24th.
Louisiana.—New Orleans, 24th.
Maryland.—Baltimore, 21st, 24th.
Massachusetts.—19th, 20th, 21st, 25th.
Michigan.—15th, 18th, 19th, 20th, 24th, 27th.
Minnesota.—20th, 26th.
Missouri.—1st, 24th.
Nebraska.—17th, 18th, 19th, 22d, 25th, 27th.
New Hampshire.—20th, 24th, 26th, 27th.
New Jersey.—5th, 20th.
New Mexico.—Santa Fé, 17th, 21st.
New York.—19th, 20th, 24th, 26th, 27th.
North Carolina.—5th, 24th.
Ohio.—19th, 23d to 27th.
Oregon.—Albany, 23d, 27th.
Pennsylvania.—5th, 19th, 25th, 26th.
Tennessee.—20th, 21st, 22d, 24th, 25th, 28th.
Texas.—1st, 16th, 18th, 21st, 22d, 23d, 25th, 28th.
Utah.—Nephi, 19th.
Virginia.—15th to 18th, 21st, 22d, 26th, 28th, 29th.
Washington Territory.—21st, 26th, 27th.
Wisconsin.—18th, 20th 26th.

The phases of the moon during June were: last quarter, 5th, 6.59 p. m.; new moon, 12th, 5.36 p. m.; first quarter, 19th, 8.42 a. m.; full moon, 27th, 6.12 a. m.; perigee, 13th, 11.12 a. m.; apogee, 28th, 12.54 a. m.

MIRAGE.

Webster, Dakota, 1st, 2d, 8th, 9th, 23d.
Traverse City, Michigan, 21st.